one processor, may also be configured to cause the apparatus of an example embodiment to filter audio signals utilizing the determined filter.

**[0010]** The computer program code, when executed by the at least one processor, may be configured to cause the apparatus of an example embodiment to determine the filter by modifying the shape of the filter based upon the size of the headphone. In this regard, the computer program code, when executed by the at least one processor, may be configured to cause the apparatus to modify the shape of the filter by modifying corner frequencies of the filter based upon the size of the pair of headphones. The computer program code, when executed by the at least one processor, may also be configured to cause the apparatus of an example embodiment to determine the filter by modifying the balance between high and low frequencies provided by the filter in an instance in which the indication of the gain for a respective frequency band includes an indication of the balance between high and low frequencies.

**[0011]** The computer program code, when executed by the at least one processor, may be configured to cause the apparatus of an example embodiment to determine the filter based on at least a difference between first and second principal components of a range of frequencies and a sum of the first and second principal components over the range of frequencies. Additionally, the difference and the sum are associated with the size of the headphone. The computer program code, when executed by the at least one processor, is further configured to cause the apparatus of an example embodiment to cause a first query to be presented regarding the size of the headphone and to cause a second query to be presented regarding the gain for the respective frequency band.

**[0012]** In a further example embodiment, a computer program code is provided that includes at least one non-transitory computer-readable storage medium having computer-executable program code portions stored therein with the computer-executable program code portions including program code instructions for receiving an indication of a size of a headphone. For example, the indication of the size of the headphone may include an indication of a large size including circum-aural and supra-aural headphones or an indication of a small size including intra-concha or in-ear headphones. The computer-executable program code portions may also include program code instructions for receiving an indication of the gain for a respective frequency band, such as an indication of a balance between high and low frequencies. The computer-executable program code portions may also include program code instructions for determining a filter dependent upon the size of the headphone and the gain for the respective frequency band and for filtering audio signals utilizing the determined filter.

**[0013]** The program code instructions for determining the filter may include program code instructions for modifying a shape of the filter based upon the size of the headphone. In this regard, the program code instructions for modifying the shape of the filter may include program code instructions for modifying corner frequencies of the filter based upon the size of the headphone. The program code instructions for determining the filter may also include program code instructions for modifying the balance between high and low frequencies provided by the filter in an instance in which the indication of the gain for the respective frequency band includes an indication of a balance between high and low frequencies. The computer-executable program code portions of an example embodiment may also include program code instructions for causing a first query to be presented regarding the size of the headphone and program code instructions for causing a second query to be presented regarding the balance between high and low frequencies.

**[0014]** In yet another example embodiment, an apparatus is provided that includes means for receiving an indication of the size of a headphone and means for receiving an indication for the gain for a respective frequency band, such as an indication of a balance between high and low frequencies. The apparatus of this example embodiment also includes means for determining a filter dependent upon the size of the headphone and the gain for the respective frequency band. The apparatus of this example embodiment further includes means for filtering audio signals utilizing the determined filter.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0015]** Having thus described certain example embodiments of the present invention in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

**[0016]** FIG. **1** is a graphical representation of the first and second principal components of a set of frequency responses of several headphones of multiple sizes and shapes;

**[0017]** FIGS. **2**A and **2**B are graphical representations of X and Y indicative of a difference and a sum of the two principal components over a range of frequencies for headphones having large and small sizes, respectively;

**[0018]** FIGS. **3**A and **3**B are graphical representations of a fitted curve defining a relationship between X and Y of FIGS. **2**A and **2**B, respectively, for headphones have large and small sizes, respectively;

**[0019]** FIG. **4** is a block diagram of a filter in accordance with an example embodiment of the present invention;

**[0020]** FIG. **5** is a block diagram of an apparatus, such as may be embodied by a digital signal processor of the filter of FIG. **4**, that may be specifically configured in accordance with an example embodiment of the present invention;

**[0021]** FIG. **6** is a flowchart illustrating operations performed, such as by the apparatus of FIG. **5**, in accordance with an example embodiment of the present invention;

**[0022]** FIG. **7** is a user interface that may be presented in accordance with an example embodiment of the present invention in order to receive user input regarding the size of a pair of headphones and the balance between high and low frequencies, such as the amount of bass; and

**[0023]** FIG. **8** is a user interface that may be presented in accordance with another example embodiment of the present invention in order to receive user input regarding the size of a pair of headphones and the balance between high and low frequencies, such as the amount of bass.

## DETAILED DESCRIPTION

**[0024]** Some embodiments of the present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all, embodiments of the invention are shown. Indeed, various embodiments of the invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like reference numerals refer to like elements